THE WHITESTONE RIVER
BY J.R. MILLS

Mills, John (1989)
The Whitestone River
THE WHITESTONE RIVER

John R Mills

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October 1989

Cover Photo : Whitestone River looking upstream towards State Highway 94 bridge and Livingstone Mountain in the background.
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In terms of land development, berm management and their effects on the Whitestone River.

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INTRODUCTION

The Reason

This project is presented as one of the requirements for the New Zealand Rural Leadership Programme. Course IX.

The Choice of Subject

The idea for this project came as the result of a controversy between the Southland Acclimatisation Society and the Southland Catchment Board which was publicly aired in the Southland Times in December 1988. The arguments will be detailed further on in this work.

Objectivity

For this project to have any value it must be objective, and every effort has been made to this end.

However it must be noted that the author farms a property adjacent to the River and has a 4 kilometre boundary with it.

OBJECTIVE

The objective of this work is as follows:

Given that the River is a Resource for the use, and benefit of all New Zealanders this project hopes to outline the view points and beliefs of the different interested parties, regarding the use and management of the resource.

While the primary objective is a collation of the various opinions it is hoped that the author will be able to draw conclusions, or at least be able to make comments and recommendations, on future river management.
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Page 15 Photo : Southland Times Article

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Figure M1

Whitestone Catchment

SOUTHLAND REGION
CHAPTER 1 THE WHITESTONE RIVER - DESCRIPTION AND LOCATION

1. RIVER - DESCRIPTION AND LOCATION

The Whitestone River is situated in the Southland Land District, in the northern end of the Wallace County.

The River rises in the Livingstone Mountains west of the Mavora Lakes and is situated about 8 kilometres east of lake Te Anau.

The catchment of 260 square kilometres is rectangular in shape about 47 kilometres in length and up to 10 kilometres in width.

The river falls from a maximum height of 1,680 metres down to 240 metres above sea level at the junction with the Mararoa River.

The Whitestone River is the major tributary to the Mararoa River which in turn flows into the Waiau River.

Refer to location maps

1.1 Topography

The Catchment can be divided into two separate areas:-

(a) The arable area which is at the lower end of the catchment.

(b) The high country area which is mainly covered in natural bush and tussock.

Most of the arable land lies below 425 metres.

The upper catchment consists of bush and tussock covered hills rising steeply in the headwaters to a maximum height of 1,680 metres.

The valley floor itself is steep and even at the lower end of the catchment gradients of 1:75 (30 feet per mile) apply.

1.2 Climate

Rainfall in the lower catchment averages around 1,200mm per annum, while in the upper catchment falls in excess of 1,550mm per annum are experienced.

Snow falls are common in the upper catchment above 600 metres, but snow storms occur over all of the catchment at various times sometimes as late as October.

Frosts are frequent and severe in winter, occurring on approximately 115 days per annum in the lower catchment.

Wind is an important local feature and the high westerly and north westerly winds that sweep the area in the spring are active agents of erosion on frost lifted or cultivated soils.
Photo 1: Example of rough grassed cover protecting the river bank.

Photo 2: Example of developing pasture to river's edge.
1.3 Vegetation

The vegetation of the Whitestone catchment consists of well grassed, cultivated ground in the lower reaches with the original bracken and tussock-covered rolling downlands having been converted to sown pastures.

The upper river flats are still in much of the original native cover of matagouri, fescue tussock, danthonia and occasional red tussock rising and merging into the bush line.

The bush is mainly poor to fair quality beech forest with Mountain Beech dominant and occasional patches of poor Silver Beech.

These forests are confined to the steeper country, reaching from the banks of the river to a height of 1,100 metres.

Above the bush line and mainly in the headwaters the cover gives way to scrub then to snow grass, but a wide variety of other native species are present.

Within the berm areas the vegetation is mainly comprised of modified native grasses and imported species growing rank. Lupin, matagouri and sweet briar are also present.

Originally a treeless landscape, the berms became even more so after the spraying of the "Crack Willows" that had spread from earlier protection works. These willows were replaced by "goat willows and golden willows". The policy has changed again and "crack willows are now being used again. This subject will be discussed further in a following chapter.

1.4 Soils

The soil type in the lower berm area is of the recent soil type known as Tuatapere soils.

They are silt loams to sandy loams, mainly shallow and stony with a high to medium natural nutrient status that responds well to topdressings of super phosphate and lime. They are free draining and have a potential for intensive grazing cropping and production forestry.

The upper berm is also of the Tuatapere soil although they are generally shallower and of a stonier nature. They are susceptible to slight wind erosion and are low producing, having a potential for occasional cropping or forestry.

1.5 Erosion

The majority of the erosion in the Whitestone Catchment takes place in the head waters where the steeply rising mountains are subject to erosion by the elements and feed a steady supply of detritus and gravel into the river. Because of the lower altitude of the upper reaches damage by scree to the forest has not been as serious as in some higher catchments. In the lower reaches wind erosion can be a periodic problem on cultivated or frost lifted ground particularly during the spring when the high westerly and north westerly winds occur.
Longitudinal bank erosion is found on most of the river bends especially where the channel consists of a single thread which can carry the full flood flow. River banks are not high, generally under 1.2 metres, but the cohesionless gravels which underlie the light silts are easily eroded and transported by the river allowing the heavily grassed top soil to fall in a lump to the river. If there is little cover this is soon washed away but if there is a heavy sole of grass this tends to bind the soil together allowing the clumps of grasses to grow at the foot of the bank, catch silt and help heal the scar between floods.

Any land use that reduces or endangers the vegetative cover will allow serious erosion to take place in the next flood. Refer to photographs nos. 1 & 2.

1.6 Water

The Whitestone River is the main tributary of the Mararoa River and in flood time is a major source of the material settling out in the Mararoa Weir and lower Waiau Channel.

Floods occur at periodic intervals and have been recorded between 130-160 cumecs. The stopbanks are designed to carry 230 cumecs with 0.6 metres of freeboard.

Normal river flows vary considerably and in dry years the river between the State highway 94 bridge and the Hillside - Manapouri road bridge runs dry.

See table below showing water flows at the Hillside - Manapouri Road bridge.

<table>
<thead>
<tr>
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<td>15.2.66</td>
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<td>8.3.67</td>
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Apart from flood flows, water quality is high. The temperature varies from 6 degrees C in the winter through to 17.5 degrees C in the summer. The pH factor is 7.4 and the dissolved oxygen between 9 and 12 mg/L. Other tests point to no deterioration in water quality over the years.
CHAPTER 2  A RECENT HISTORY AND FACTORS THAT HAVE CONTRIBUTED TO THE RIVER'S CHANGE

The 260 square kilometre catchment area of the Whitestone River is located in what was one of the more remote regions of Southland and up to 1953 had only three permanent residences within its boundaries.

About that time the Lands & Survey Department took over the 25,000 hectare Lynwood Block for Farm Settlement, and have since been busily engaged in implementing a policy of land development on this and other properties until at present there are approximately 37 properties and 7 Lands & Survey Blocks paying rates within the Whitestone Catchment.

Two thirds of the catchment is now developed or in the process of being developed.

With the conversion of the rough native cover to exotic pasture grasses, plus the drainage of swamps, wetlands and other detention areas, very rapid runoff began to occur, with serious results for the lower farm units. With the steep river grades of 1:175 (30 feet per mile), the frequent small floods began to cause serious bank erosion.

It wasn't until the settlement of the first Lynwood Block units on the Whitestone River Flats in 1964, that the Lands and Survey Department requested the assistance of the Southland Catchment Board to provide subsidised assistance in combatting erosion in the lower reaches.

There were long lengths of high eroding banks, fences falling into the river and grazing and cultivation had been carried out right up to the edge of the channel.

An inspection of the problem showed the need for a total River Control Scheme.

As most of the riverside land had not been settled and was therefore still under the control of the Lands and Survey the Catchment Board proposed that a wide strip of so called "Berm Area" be withheld from freehold titles.

A survey was made of the main river bed, and the limits of the proposed berm areas were defined on mutually acceptable lines. It is understood by the author that the Catchment Board required a terrace to terrace "berm" but because of the pressure from the Lands and Survey for farming land the boundaries were drawn after negotiation and took into consideration existing fencing, location of stopbanks, bank protection, possible meander migration and the economics from the point of view of future settlers. As can be seen from some of the enclosed photographs the resulting berm was very much narrower than was first envisaged by Catchment Board staff.

It was felt that the Board could prevent the recurrences of the continual problems encountered in the earlier settled areas, where the old 1 chain reserve gave the larger single thread rivers inadequate breathing space. Continual expensive bank protection works were necessary to control lateral erosion of highly developed riverside farms.

The retention of a wide berm or buffer zone would allow the river to have room to move without interfering with fencing or farming operations.
The natural heavy grass and tussock would help bind the edge of the river and while not eliminating erosion would help minimise the effect, particularly during times of flood when there is a sheet flow over most of the berm area.

It was realised as soon as the numerous over-flows or safety valves used by the river in flood times were blocked and the whole of the flood water contained in the main channel, major bank and channel erosion would occur.

The steepness of the channel made the construction of river cuts inadvisable because it only increased the speed of flow of the river. It was thought that the only satisfactory method of protecting banks was rock work backed up by willow planting. Eroding bends between the groynes were planted with willow or poplar poles at 2 metre spacing, while dry runners and abandoned water courses in the floodway were planted with willow or poplar poles to help prevent the river from redeveloping them.

The overall catchment scheme consisted of 90 kms of channel works to improve drainage outfalls, 20 km of stop banks, 54 km of berm fencing, rock groynes, pole planting and provision for extensive follow up works.

It was unfortunately necessary for the first of the farmers settled along the Whitestone River to be provided with licences to lightly graze the berm. These licences were often abused and the result was severely damaged stop banks, protective growth and plantings.

As the Whitestone is snow fed, and thus subject to spring floods, loss of cover is serious, and cases of deep scour on heavily grazed areas and along the toe of stop banks have occurred. Where stock have been totally excluded, or where the only use has been for hay, willows and groynes have survived with very little attention.

This caused the Board to decide in 1975 to cancel all temporary permits to graze the berm. Even after these cancellations there was and still is occasional grazing of the berms.

Unfortunately the Board does not have adequate power to enforce these laws which prohibit the grazing of the berms.

For this reason the Catchment Board has investigated the possibility of having the whole of the Whitestone River Bed and Berms declared a Soil Conservation Reserve under Section 16 of the Soil Conservation and Rivers Control Act 1941.
CHAPTER 3 PRESENT USE AND POLICY

3.1 Gravel Extraction

There are 4 gravel licences in force on the Whitestone River.

The supply of gravel is important to the district, while controlled gravel removal can be beneficial to the channel.

3.2 Water Rights

There are 2 existing water rights on the Whitestone River and 1 on the Kakapo swamp which is a tributary of the Whitestone.

The 2 Rights on the Whitestone are:

(a) A Crown Water Right for 458 cubic metres per day for the "Homestead" Community Water scheme where water is pumped to a reservoir and then gravity fed to surrounding farms.

(b) Right to McGregor Concrete to take 173 cubic metres per day for the purposes of washing gravel. This right is only exercised approximately 2 days per week and is confined mainly to the winter as the river can run dry in the summer.

The Kakapo swamp right is to take 785 cubic metres per day and is for the Ramparts community water supply.

The net effect of the two water rights on the Whitestone is a maximum loss of 0.015 cumecs from the river.

While this may appear negligible, the extremely low flows experienced in the lower reaches in the summer would make the granting of further water rights in that area subject to extreme caution. Upstream of the State Highway 94 bridge the summer flows would be significant for any further applications to be treated on their merits, but with the realization that continuing development and drainage of the country upstream could well decrease the summer flows even further.

3.3 Angling

The main recreational pursuit within the berm areas is fishing, though compared with the more popular fishing waters in Southland, angling pressure is light. The resident trout population of the Whitestone consists of a relatively small number of large well conditioned fish, the presence of these trout depending to a large extent on the availability of suitable cover such as deep holes. Juvenile trout migrate downstream to the Mararoa River, and may return later as mature fish during the spawning season. Spawning surveys indicate that the lower 2.5 kilometres of the river, and the area from above the state Highway 94 bridge to Moat Creek are the main spawning localities. This part of the river is within the area of farm development. It is possible that the increased runoff plus the addition of nutrients to the river as a result of increased farming activities may increase the algal growth. This together with the movement of fine shingle may have a deleterious effect on bottom fauna numbers.
The Whitestone periodically runs dry in the Summer months between State highway 94 and the Kakapo Creek, this limits the best fishing to early in the season. The drainage of wet areas adjacent to the berm has resulted in the water retention effect of these areas being lost and this has accentuated the problem in recent years.

One of the important aspects of the Whitestone as a fishery is its close proximity to Te Anau. The river is able to provide easily accessible and quality angling close to a tourist centre.

3.3a Fishery Requirements

The requirements for the river to continue to be a good fishing river are covered in detail in a submission to this work by the Southland Acclimatisation Society. See chapter 7.

The main requirement of a fishery is a stable and well managed river.

I believe this requirement is consistent with any other river use and in the best interests of all parties.

After talking to many fishermen and Acclimatisation staff over the last 8 years I am left in no doubt that the standard of the fishery has been steadily declining, and this decline shows no sign of reversal.

3.4 Picnicking

There are 3 areas that have been set aside for picnicking and they are all relatively close to main roads to enable ready access. All parts of the berm are used for picnicking during the summer, but present usage is not high due probably to the availability of so many other sites which are easier to get to.

3.5 Water Fowl Hunting

The hunting of water fowl on the Whitestone is only a minor use, due mainly to the lack of suitable ponds. Some ponds were constructed in the early stages of land development, but unauthorised excavations are no longer permitted in the Berm. The main species hunted are Ducks (Mallard/Grey and Paradise). Canada Geese are also hunted.

It is ironic to note that the very engineering works which are detrimental to the fishery, are often providing the shallow channels and back waters which have much improved the duck populations and have greatly added to bag numbers, particularly of Paradise ducks.
CHAPTER 4 POTENTIAL USES

4.1 Grazing

There has been no authorised grazing of the benn area since 1975, when all temporary grazing permits were cancelled due to over stocking and damage to tree plantings.

There is still the occasional case of unauthorised grazing on the benn but they are becoming less frequent as more people become aware of the importance of preserving the natural vegetative cover in preventing soil erosion.

Another important factor in enforcing the exclusion of grazing animals from the benn area is the increasing rate demands being charged to adjoining land owners. Rate payers are generally not prepared to see damage being done to the channel bank by their neighbours sheep, because they know that this could further increase their rates.

It is now generally accepted that grazing of the benn area is inconsistent with water and soil conservation objectives.

4.2 Hay Cutting

There are some areas on the benn where it is considered feasible to cut hay on land that is not affected by flooding or subject to erosion. The total area in this category is 9.3 Ha. The adjoining landowners are given the licences to cut the hay.

Hay cutting is considered to be beneficial to the berms and for this reason there is no charge for these permits.

There is only a very small portion of this area that is actually being used for hay at the present time.

4.3 Tree Planting

Any tree planting within the berm has to take into consideration that the berm is primarily a floodway and no plantings should in any way constrict or effect the efficiency of the floodway.

This restricts the areas which are suitable for production planting.

It is also necessary to choose areas which are fertile enough to support trees and have access suitable for the management of such stands.

The Catchment Board have indicated that they are in favour of production forestry as long as it is compatible with the primary objective which is soil and water conservation.

Some individual farmer ratepayers are in favour of production forestry on suitable areas. They argue that any profits generated in the future can be used to fund the on going protection and maintenance work in the berm area.

This view is not shared by the majority of adjoining farmers who through the ratepayers liaison committee have stated that they are unwilling to
risk the farmers capital to such a scheme

There are also areas which have been designated as suitable for amenity planting, mainly near the main highway and near picnic and rest areas.

Protection planting will be covered in another chapter.

Reference: The main source of the previous 4 chapters is the
Whitestone River Proposed Berm Management Plan.
[ Southland Catchment Board Job No.717.]
CHAPTER 5 THE PUBLIC DEBATE

The following chapter records the public debate by interested parties.

It was a result of a breakdown in communications between the Southland Catchment Board and the Southland Acclimatisation Society, that the debate spilled over into the public forum mainly in the Southland Times. The object of documenting this saga is to illustrate the views and claims of the opposing agencies and individuals.

Southland Times - Public Opinion
16 December 1988

AMERICAN NOTES DECLINE OF SOUTHERN TROUT FISHING

Sir, - I have empathy for some of the sentiments expressed in the letter of December 9, particularly the friendly people ... magnificence of the mountain scenery and pastoral beauty of Southland. I disagree, however with some of the assessment, particularly that of the trout fishing. While I agree that Southland still possesses some fine fishing, it is important to recognize that the quality of some rivers and of the trout fishing is declining. Some of the decline is rapid. The three great rivers of Southland, the Mataura, the Aparima and Oreti are but shadows of their former selves.

I am not an experienced international trout fisherman and am very sad to criticize but feel it necessary to relate my experience.

The Mataura was undoubtedly the finest brown trout river in New Zealand and ranked with the best of the world in the prolific fly hatches and quality of trout. During a hatch a good fly fisherman could land 20 or 30 trout. The hatches have greatly diminished and therefore the trout.

The causes appear to me to relate less to increased pressure from anglers than the loss of habitat and the quality of the river itself. Willow clearance, silting of gravel, erosion of banks due to heavy stocking by sheep and cattle are prime causes. The damage does not appear to be countered by careful maintenance of the river.

Another prime example of change is that of the Hamilton Burn which many Americans regarded as one of the finest small brown trout streams. During a hatch it was commonplace to see in 50 yards of this fine clear stream as many as 20 trout - two to five pounds in weight - taking the Deliatidium mayfly. Some American fishermen came to fish the burn year after year.

The Oreti River was internationally famed for its huge trout and particularly see run through. High country development and drainage of wet lands have created rapid and heavy runoff and huge movements of gravel. Wetlands are the natural reservoirs for maintenance of river flows. Destruction of pools and heavy silting have reduced the habitat for some of the finest brown trout in the world. Gravel extraction and the use of very heavy machinery in the river bed by the Catchment Board have exacerbated the problem.

I have examined some of the work this week and am astonished that it should be allowed.

The digging of a deep hole, sluicing and washing of gravel in a huge project upstream of the Mossburn bridge has resulted in silting and damage to river life. Down river piles of loose gravel in the middle of the river bear testimony to the futility of much of the board's work. Each flood this loose gravel washes downstream and fills in the pools; the result is loss of fish habitat and a lot of fishless water.

The Weydon Burn, a once fine spawning stream has almost been destroyed by overgrazing and development. The Acton, now subject to river bank grazing, will go the same route unless something is done quickly.
Catchment Board work on the Whitestone River has already done considerable damage to this fine brown and rainbow dry fly stream.

The River Waitaki in Otago and Canterbury is another case which fishermen, tourist operators and Government alike should study carefully. This was one of the greatest trout rivers in the world; its 4.8 miles from the Waitaki Dam to the sea provided in excess of 250 river bank miles, with many small and heavily stocked streams with great tourist potential.

Experiments for further hydro development almost wiped out the trout population in the late seventies. The river has now much improved and signs are propitious that without further development and with better management, the Waitaki will again provide fine sport for thousands of anglers. Further development, however, is now being strongly canvassed, supported by a study which is suspect and seeks to replace a great river with a small river, canals and power stations.

If the present rate of degradation of rivers continues my forecast is that the trout fishing in the South of the South Island of New Zealand will be second rate compared with that in heavily populated countries which have learned that care of environments is cheaper than restoration.

Much of the damage already done cannot be repaired; I believe you have little time left in which to halt the decline and suggest that New Zealanders need to consider that if they want living rivers, what their responsibilities in conservation really are and how they can become responsible stewards of what is still a very beautiful and natural resource-rich land.

I am told that a major problem is that your acclimatisation societies have no teeth, that catchment boards are less interested in serving fisheries management than landholder interests.

Fishermen of course are also occasionally unbalanced in the pursuit of their own interests so perhaps you should consider alternatives to the current management system of your rivers.

I do not believe you can afford to delay any further.

E. P. Anderson
San Francisco

Southland Times - Public Opinion
19 December 1988

BOARD RESPONDSTOTROUT CLAIMS

Sir - The letter published in your December 16 issue from Mr E P Anderson, an American fisherman, invites some response from the Catchment Board to give a balance. Several of the statements are at variance with extracts from the Southland Acclimatisation Society's 1987 and 1988 annual reports and he should read these.

It must be acknowledged that criticisms of the board's local activities are often in retrospect and reflect a change in public opinion. In the 1950s and 1960s, the cry was for development, drainage, river protection schemes, more wool, more sheep, more butter. The Board responded to this and the public of Southland accepted the prosperity that followed with both hands.

Public opinion has now changed and the board is trying to cope with this.

Swamp and major land drainage schemes are no longer subsidised while new practices such as fencing out of forested areas, retirement of eroded country, gullies and river berms, beautification planting as part of schemes, weed control in river beds and stricter control on gravel extraction are board responses to these changed public demands.

It is very difficult to make progress unless public attitudes change. As an example, in 1974 the board tried to correct a problem of water pollution from gravel extraction direct from the river. At a public meeting the board took a hiding from...
other local bodies, gravel contractors and farmers who were selling gravel but received no support whatsoever from environmental groups. It was not until 1986, when public opinion had changed, that the board successfully negotiated procedures to correct these practices with the result that the lower Oreti and other rivers now run clean most of the year and the fishing has improved markedly.

The undesirable alternative source of gravel from mining good Southland farmland has thus been avoided by negotiated compromise acceptable to all.

The matter of stability of high country streams mentioned by Mr Anderson has been a Southland Catchment Board concern for over 25 years.

In the mid 1960s, I mapped all of the Te Anau and Northern Southland river beds and with Lands and Survey staff prepared a scheme for the board which eventually resulted in 340 km of new fencing being erected along both banks of all the major rivers and streams in the area.

Title boundaries, existing farmed land margins and fences were set back to encourage re-establishment of native vegetation and exclude stock while control of noxious plants become a rating district commitment still continued today.

Throughout the whole of Northern Southland, there are examples of the board’s foresight. The fencing out of numerous swamps, wetlands and gullies, the whole of the Home Creek swamp, Lagoon Creek and Dawson City wildlife areas, the retirements of the complete headwaters of such streams as the Hamilton Burn along with wide strips of the berms of the upper Oreti, Mararoa, Mautara, Upukerora, Whitestone and many others are examples.

The board was in the forefront of this work and 20 years before adoption of the funding of it nationally special Government approval was given to Southland following board representations.

Of course, not everyone will be happy with what the board does. Willows that shade trout and ducks impede drainage and cause flooding of farmers’ land, erosion of stopbanks by river changes require instream works of damage to fisheries habitat, gravel extraction for industry and realignment to protect roads and bridges causes discolouration. The board is accused by fisheries people of only considering farmers’ interests - farmers complain when they are flooded or when their streams are not cleaned during duck shooting, whitebaiting or trout spawning.

In situations where the board has a role of ensuring multi-purpose use of a resource, such as a river, there are matters of resolving conflict between jet boaters, fishermen, gravel contractors, water supplies, disposal of effluent and demands for flood protection. Only a super optimist expects to be able to please everyone.

As a fisherman myself, as are the majority of the board’s senior staff, I would not like to see Southland’s rivers deteriorate to the condition I have seen in many lakes and rivers in Mr Anderson’s own country.

I would make the offer of showing Mr Anderson the other side of the coin to balance the views he has been reflecting.

It might even give me a chance to get off my chest the fact that I have spent my whole working life patching up the country after the liberation by sportsmen of deer, rabbits, possums, goats, hares and wallabies!

Changes in public opinion now limit such madness, are resulting in the saving of our remaining native forests and eventually will encourage farmers to prevent damage to stream margins by stocking because it is in their own long-term interests to do so without other encouragement.

N.A. McMillan

General Manager

Southland Catchment Board

Invercargill
Southland Catchment Board protection work on the Whilestone River, near Te Anau, has angered the Southland Acclimatisation Society, which is concerned at harm to the river and its fisheries. Society manager Mr Maurice Rodway (left) and field officer Mr Stuart Sutherland view alterations to the river. On the right is the grassy bank the river once followed and on the left is the new channel formed by the Board.

Keren Fallwell reports: page 8
CATCHMENT BOARD WORK ON WHITESTONE RIVER RUINING FISHERIES

By Keren Fallwell

Southland Catchment Board work on the Whitestone River has angered the Southland Acclimatisation Society, says it is ruining fisheries and destabilizing the river.

The river, near Te Anau, is a popular area for anglers and tourists but the society says the board's moves to protect surrounding farmland are threatening the life of the river.

Each time the Whitestone threatens farmland the board diverts the river and the society's manager, Mr Maurice Rodway, fears the once meandering river could become a straight flood channel.

The problem goes back to the 1960s when land settlement by the Department of Lands and Survey began.

The department, looking for as much land as possible, wanted to develop close to the river.

The Catchment Board, to its credit did not give its approval to develop right to the swiftly flowing river, Mr Rodway said.

However, the stopbanks erected were not always on the natural boundaries and in some places were too close together.

Now, thousands of dollars a year goes to keeping the river within its confined path.

One year $100,000 was spent on the river and $4,000 has been paid to protect land which Mr Rodway estimated is worth $600.

As the river is taken away from farmland its natural meanders are lost and with them go ideal fishing spots. The straight, shallow channel that is formed is not suitable for adult trout, who prefer deep, cool waters, often under overhanging grasses and trees.

The Whitestone does rise but does not often flood badly and in the summer it has a history of warming, which adult trout do not like. The shallow waters will heighten the problem.

Mr Rodway said the society has had complaints from anglers who say fish numbers are declining and ban counts by the society indicate the "channels" are not supporting adult trout.

"Our role is to protect wildlife and fisheries habitats and we can't do this under this regime," Mr Rodway said.

The Board has planted willows in some areas but they take five years to reach a reasonable size and in the meantime the river is diverted if they are threatened.

The society also suspects the movement of gravel is destabilizing the river and making the problem worse.

Surrounding vegetation, which the river work disturbs, provides some stability, and where necessary rocks would be preferred to the shingle the Board is using.

"In some places they come back time and time again, but in desperation rock has been dumped. It's expensive, but an extra dollar or two spent now may be advantageous in the long run," Mr Rodway said.

The Society does not want large areas of good farmland flooded but believes the river would be better left alone, especially in places where a natural boundary, such as hills, is close.

"We are advocating in these cases the Board could purchase the land and then lease it for grazing with the farmer accepting that ultimately the land will be lost but he hasn't lost financially," Mr Rodway said.

He sees the scheme's funding at the root of the problem.

All farmers in the catchment area pay a rate and they would probably feel cheated if they received nothing for it.

"If farmers paid a lower rate a lot of this work, which is not really necessary, wouldn't be done," Mr Rodway said.

The farmers' rates meet some of the cost and the taxpayer meets the rest.

"SMPs have been removed but this is a good example of subsidized work still going on and causing quite a bit of environmental harm." The Catchment Board's General Manager, Mr Neil McMillan, does not agree that buying land along the river would solve the problem.

"The farmer has to abandon his living .... the farm is set up as an economic area depending on certain areas. They won't want money, the will want more land," he said.
Society would be "better to stick to fish." He suggested the Acclimatisation Board should pay higher rates or not.

Mr McMillan said the Board had agreed and would continue to do it.

A subsidy of about 35 percent was paid on the work but subsidies were being scaled down and the farmers would have to consider whether they wanted to pay higher rates or not.

Mr McMillan said the Board had the right to do the work under its general authorisation and would continue to do it.

He suggested the Acclimatisation Society would be "better to stick to fish."

Southland Times - Public Opinion
23 December 1988

ACCLIMATISATION SOCIETY
VIEW ON STATE OF RIVERS

Sir,- The comments of E P Anderson published in the Times of December 16 are similar to those of other anglers we have received from time to time.

Many of the comments are true; but some can be refuted by our own measurement and counts. This letter attempts to correct some of these views and also comments on the letter of Mr N A McMillan published on December 19.

The Mataura River is still a very fine brown trout fishery. The reason for this is because it is a large river with a relatively stable bed and in the main, good water quality. In the past the stability was protected by willow trees which lined the banks but the removal of many of these, followed by a series of floods, has resulted in an increase in bank instability in places which may be contributing to an increased level of suspended sediment in the river. We are currently working with the Catchment Board in trying to pinpoint the source(s) of this sediment.

The society has tried to promote a more conservation oriented approach to willow tree management in the Mataura and other rivers but our requests have not always been heeded. To the Board’s credit, however, it needs to be stated that there has been a great deal of good work done in the planting and layering of willows in the Mataura and other rivers. In addition to providing bank stability this has provided good wildlife and fish habitat. There are other places, however, where a little flexibility and foresight could have prevented losses of good trout habitat.

The most obvious place where this approach is absent is in the Upper Mataura between Athol and Garston where extensive willow removal has lead to localised, but quite serious, loss of good trout and wildlife habitat.

Mr Anderson’s comments on the decline of fishing in the Oreti River are not borne out by our observations or historical records. Some days anglers might not be able to catch trout, but that is not because there are no fish there. We agree that the gravel extraction works do cause problems. Some of these works are currently subject to legal investigation so it is hoped that this will eliminate these detrimental effects in the future.

The Oreti River still yields trout in the 15 to 20 lb range each year and the average size of good trout has apparently not declined since 1937 when one good catch of 42 fish taken from there and the Mararoa, averaged 5 lb. In fact, they are probably bigger now and there is an average of 235 fish per kilometre, ranging from 8 to 72 per kilometre, in the reaches above Mossburn. This density is quite high when compared to other New Zealand rivers of a similar nature.

One area on the Oreti which may have suffered over the past few years is that between Mossburn and Lumsden. This has been subject to many river diversions. The society has been invited by the Catchment Board to comment on these river works and has been able to reduce their scale in some instances. These works have been done by the Catchment Board at the request of local farmers.
farmers who pay rates to have their land protected from the river. In some cases the works were unavoidable, but others could have had a lesser impact on the fishery if the society's recommendations could have been accommodated.

The Whitestone River has probably been the most affected by river diversions over the years. The view of the society is that much of this work cannot be economically justified and it is causing significant damage to the fishery. We are attempting to remedy this at present.

In spite of these areas of loss there are still many good trout fishing locations in Southland. We know that anglers can still catch 20 to 30 trout in an evening on the Mataura, and have done so recently. Catches of 10 fish or so occur regularly - in fact an angler reported on Monday he caught 12 fish there on day last weekend. We have received several limit bags in the Upper Oreti this season, with most of the fish weighing between 4 to 7 lbs. Several experienced anglers have reported many parts of the river to be "full of fish".

This is not to say that we should not be concerned. We are concerned, and are attempting to improve the management of river systems for the benefit of wildlife and fisheries wherever we can.

It is not true that the Acclimatisation Society has no teeth, but unfortunately, local authorities have bigger teeth so we are unable to back up all of our requests for mitigation with a legal remedy. Laws which allow for fisheries protection can often be overridden by laws which control land and water management.

Next year a new set of laws governing uses of rivers and other natural resources will come into effect. We have been making strenuous efforts to ensure these laws more fairly protect wildlife and fisheries values and the interests of recreational users in general.

There have been many land use decisions made by the Catchment Board that have been beneficial and your correspondent's criticism of the Board needs to be tempered a little.

The fencing of many of our high country streams has been possible through the decision of the Board although the Acclimatisation Society often acted as a catalyst. Where this has occurred our rivers are still in great shape. The Upper Oreti and the Mararoa are two good examples.

While these schemes have been beneficial there is no doubt that engineering works, which involved river diversion or channelisation, carried out elsewhere in the rivers of Southland have been the single most important factor in damaging good wildlife and fish habitats in our rivers and streams.

In Southland trout fishing is an important recreation and a growing part of the economy, its protection is the responsibility of all Southlanders. Much has been done in the past so we do still have a world-class trout fishery, but there is plenty of room for improvement and active protection of what we have at present is essential.

M A Rodway Manager Southland Acclimatisation Society Invercargill

Southland Times - Public Opinion 3 January 1989

RESEARCH INTO DAMAGE TO TROUT STREAMS UNDERWAY

Sir, - Your correspondent in a letter headed "American notes decline of southern trout fishing" (December 16 1988) suggests that New Zealanders should consider alternative management systems for their fishing rivers, rather than the current practices of willow clearance, gravel extraction and grazing in the river banks.

It is suggested that a major problem is the "acclimatisation societies have no teeth, that the catchment boards are less interested in serving fisheries management than landholder interests."

We are in no position to comment on the validity of the latter suggestions but offer the comment that one of the real problems is lack of scientifically defensible information that would allow those bodies to make sensible decisions in the management of rivers. There is a great deal of controversy between conflicting interest groups about the effects of current management, and you could argue the toss until the cows come home but still not resolve the issues unless proper studies are done. To this end, we wish to describe some research being conducted in Southland on the effects of grazing on streams and rivers.

The Water Quality Centre, DSIR has been evaluating the effectiveness of protecting streams by fencing off stream sides to provide a buffer zone between grazing land and stream channels. In Southland, we are carrying out this work with the Southland Catchment Board and...
Southland Acclimatisation Society on six streams in Northern Southland, including the Hamilton and Weydon Burns described in E R Carson's letter. The stream sides in some reaches of these streams were retired in a programme agreed between the land owners and the Southland Catchment Board between 1975 and 1980.

In this study we have carried out detailed surveys of the retired reaches and compared them with grazed reaches on the same or similar streams. In addition, we have inspected numerous other streams and rivers in the area. We have only just completed the second of two surveys and many of the results are still to be analysed. However, we are able to make some observations on the effect of stream side grazing.

Our surveys are only "snapshots" of what is a continuum of changes. The will show any changes over recent times (10 to 20 years), but this seems to be the time frame over which your correspondent has observed the deterioration of the fishery.

In small streams (1 to 2 metres wide) there is a high likelihood of damage from cattle grazing the stream edge. We have observed this in a few of the small streams we investigated. In the larger streams, such as the Hamilton and Weydon Burn, it is very difficult to see any widespread damage that may be attributed to animals having access to the stream banks. There is certainly animal tracking along the top of banks and isolated widening due to stock crossings. However, we found no changes in the habitat or the fish food organisms. This was a very surprising finding; previous circumstantial evidence strongly supported the idea that streambank grazing produced rapid deterioration of stream channels. We did observe major disturbances where channels had been straightened and deepened to improve farm drainage. Often this disturbance was the result of erosion that occurred after channel works.

A key factor in understanding the effect of farming development in the Southland area is the nature of the local subsoils. Soils are usually underlain with gravels that are easily eroded by high flows. If these gravels are exposed through man-made or natural changes, then the channel will become unstable.

Under the recent history of high intensity rains a fair proportion of the streams we examined have become unstable, resulting in widening and deepening of the channel. This has happened in many streams draining the northern Taringatura hills. In extreme cases this has resulted in the complete destruction of trout habitat, as in parts of the Centre Burn near Mossburn.

We have only addressed one of the ways in which farming affects streams and rivers. There are many other factors, some of them mentioned in E R Anderson's letter, which are also controversial and need investigation.

Observations and views from farmers, fishermen and other people who use streams and rivers such as those expressed in the letter are of great benefit to us. We hope that other people will communicate with these through this forum.

Bruce Williamson, John Quinn, Keith Smith - Scientists, Water Quality Centre DSIR, Hamilton
There are some important questions still to be answered, the society has, in the past, identified some specific practices which have caused losses to our resource.

Mob stocking of cattle on stream banks is one, and removing gravel bars from small streams is another.

Practices such as heavy stocking of cattle, deer or sheep on stream banks and the clearance of flaxes, tree and other dense vegetation from stream edges definitely damages trout fisheries. Evidence for this can be found in parts of Southland and, in fact, throughout the world.

One other subject in need of closer examination is the effect of gravel removal and mechanical river bed disturbance in rivers like the Oreti, Aparima and Mataura.

The abstraction of thousands of tonnes of gravel from these rivers still occurs even though some river engineers accept that gravel plays an integral role in the maintenance of stream stability. The effects of this in the Southland situation have been quantified.

However, elsewhere it is known that gravel removal gives rise to a series of harmful effects. These effects impinge on the biological and physical nature of streams and rivers.

Like gravel removal, stream channelization has many detrimental effects. It increases the erosive power of water and the subsequent erosion tends to broaden the stream channel, reducing trout habitat.

The removal of streamside vegetation also increases erosion and in-stream sedimentation and, in association with flooding, leads to channel widening.

All of these factors combine to reduce in-stream ecological diversity and lead to poorer trout fishing.

As evidence of the above, consider the society's 1987 annual report which presented figures indicating that adult trout prefer deep water and willow-lined pools in parts of the Oreti River but were not found in shallow pools with little cover, similar to those which result from river channelization works.

Also MAF staff who counted trout in the Oreti noted a decline in the number of large trout in a section of the river 4 km above Rocky Point between 1985 (27 per km) and 1988 (19 per km).

They said the decline was consistent with changes in in-stream habitat. In 1988 the reach "had been a single thread channel forming a fast deep run with a cobble substrate."

In 1988 it was "braided, wide, and shallow with much lower water velocities and finer substrate."

In January 1988, two months before the last MAF count, a gravel extraction operation had to be reprimanded for operating illegally 2 km above the MAF fish counting site.

Similar changes to rivers worldwide are carefully documented in the international scientific literature.

In addition, workers in other parts of New Zealand note that the widespread practice of channelizing gravel bedded rivers into single channels in
In this country to reduce gravel accumulation may not achieve that at all.

In spite of this knowledge diversions, channelizations and large scale gravel removal works still occur in the Aparima, Whitestone, Oreti and Mataura.

The observations of river bed destabilization made by recent correspondents to the newspaper, our own staff and a number of others, are certainly supported by the scientific literature.

We are working to encourage a more critical evaluation of these river works, and the effects of the river extraction on the biological and physical characteristics of our rivers.

On the subject of new institutions to monitor rivers, we do not believe that all of the solutions advocated by a correspondent, Mr Phillip Russell, are practical. The Acclimatisation Society does, in fact, do all of the practical things he suggests.

In effect, every angler can act as a ranger. Society staff are always available to investigate any activity that could be damaging trout fisheries - they are only a phone call away.

There is an obvious need for better management of our rivers but there is no need to set up new organisations.

We must protect rivers which are valuable "social, recreational and economic resources" and while we do experience difficulties at times, the present ways of administering this resource are fundamentally sound and should be adhered to. The problem is not so difficult. Information is already available to help us make decisions.

Some good decisions have been made, some have yet to be made.

New Information is being collected and whenever a good case can be argued, ultimately the right decision will be made.

Time is of the essence. The more public pressure that can be applied the sooner the damaging practices will be stopped.

Southland Times - Public Opinion
27 January 1989

TROUT STREAMS

Sir, I wish to refer to the photo and article in the Times of December 23, 1988, regarding the Whitestone River and the modifications carried out by the Catchment Board.

Now that time has been allowed to pass, during which decisions may have been made or views formed, I would like to give the pot a bit of a stir up, and ask the Catchment Board what it intends doing to rectify the complete shambles it has made out of a beautiful natural mountain stream. Its cry of "protection for valuable farmland" has absolutely no base, as most of the land bordering the river is "marginal" to say the least.

Mr McMillan's statements that "whole runs could be destroyed by removing the flats" is typical of the type of statements that people in his position use to justify their actions.

I have enjoyed fishing the rivers of Southland for 34 years and have been involved with the politics of angling for 12 years. During this time, the decisions of the various factions who would alter the pure state of a water way in order to extract more dollars from it, have often proved to be ill-informed, ill-conceived, and carried out to such a degree of overkill that what remains becomes totally useless to those people who wish to use the waterway simply for the aesthetic, soul-nourishing values it has endowed with by several thousand years of management by "Mother Nature".

It is high time that the total
management of waterways was delegated to people whose minds are ruled not by the “almighty dollar,” but by the feelings that a small amount of careful nurturing will provide a resource that will never be depleted, rather will grow, and provide a source of enjoyment and wonderment for generations to come.

Peter J Sayers
Executive Member N Z. F. A.

Southland Times - Public Opinion
27 January 1989

LETTER REFERRED FOR COMMENT BY MR P J SAYERS ON TROUT STREAMS

To date the whole debate on Board works on Southland Rivers has been led by people with a single purpose use of the Regions rivers.

I have to point out that the Board is in a much different role having to balance all of the needs and legitimate uses of a wide variety of users.

The photograph Mr Sayers refers to did indeed show a view of Board works which highlights all of the things fishermen would be concerned about. That was its purpose. What it did not show was the hole in the farmers stopbank, the difficult alignment of this reach of the river and the farmers view was not sought on the suggestion that the Board should abandon him. There was no admission that the Board staff had met with fisheries people on the site previously and agreed on a modification to the works to minimise any adverse effects nor that the work was necessary to allow the planting of willows which long term will prevent the need for such future work at this spot.

There are many groups interested in using and utilising the waters of the Region and many of these uses, if allocated a priority are exclusive of other legitimate uses. I would be interested to hear the views of farmers, gravel contractors, canoeists, jet boaters, industrialists and local body people as well as I feel the debate is becoming a little one sided.
Southland Times
4 February 1989

COMMITTEE TO VISIT
WHITESTONE RIVER

The stand-off between the Southland Catchment Board and the Southland Acclimatisation Society over the Whitestone River may soon be broken.

At its meeting yesterday the works committee agreed to visit the site, near Te Anau, meet board staff and later meet the acclimatisation society.

The society claims the Board is ruining the fisheries and destabilizing the swiftly-flowing river by redirecting it to protect surrounding farm land.

It has been suggested the board buy land affected and allow the river to take its natural course.

But in a report to a the meeting the Board's General Manager, Mr. Neil McMillan, said land purchase would create "all sorts of difficulties."

"Where an upstream owner wants to abandon his land .... the result would be flooding of downstream properties he said."

"There would be demands for replacement land from the existing river bed, problems of valuations, survey costs, relocation of fencing drains ... while the river problem would continue to worsen."

A strict policy would be "completely unworkable" and in most cases the matter should be left to the board's staff, Mr McMillan said.

Committee chairman, Mr John Low, said the irony was that the Whitestone was one area where the Board had moved landowners away from a river.

When the land was first settled it did not allow it to be developed as close to the river as the Lands and Survey Department wanted.

Mr Owen Horton said even if the berms were made wider there would still be a problem with threatened land.

Mr Ivan Pilgrim said it was important the river was kept away from the stopbanks as if it went through the banks it destroyed farm land.

Southland Times - Public Opinion
4 February 1989

MORE DEBATE ON TROUT STREAMS

Sir,

The comments on Mr Scott's letter have prompted me to abandon ideas of a fishing trip to hurriedly complete a letter I had in the pipeline on the subject, while it is topical.

I agree with Mr Sutton and Mr Rodway that many Catchment Board activities are beneficial to our fisheries and in fact I know that this co-operation is Board policy. What fisheries managers are concerned about is the damaging work being carried out independently of the Board, that is without the Board's knowledge or authority.

I submit the following abridged report on the Whitestone River illustrating the nature of the problem in the hope that the Board will take urgent steps to rectify same.

"On Tuesday, December 8th, I accompanied society staff on an aerial and ground inspection where we met Catchment Board engineering personnel. Even though exchanges were occasionally heated, I sympathize with Board field staff who have to work by the seat of their pants for lack of a management plan, unsatisfactory guidelines, and in the absence of professional hydrological vetting of river diversions works. Nevertheless the fishery is being adversely affected to my mind by unwise channel realignment; and like it or not, we must take whatever legal redress is available to us, to ensure that our concerns are accommodated.

The above views and what follows are not necessarily the
opinions of society staff. The problems on the Whitestone would appear to be caused by:

1. Unwise land use planning of the valley by Lands and Survey. The freeholding of portions of the ancient riverbed makes it inevitable that at the first sign of an erosion threat the resultant squeal by the landowner, short term protective measures have to be put in hand.

2. The location of berm boundaries encroaching upon the natural meander pattern of the stream. This inevitably leads to re-alignment of the river down the middle of the freeway when berms and any associated stopbanks are under threat. An aerial view of these meanders, abandoned and replaced by canal-like diversions, is most disturbing.

I believe that in some cases the purchase of relatively few hectares of freehold (available to the owner for grazing) and the rezoning of some constricting berm areas would allow the natural meander to redevelop and save large sums presently being spent on temporary works. (I understand this to be in the order of $100,000 annually). We were advised that board policy inhibits the purchase of these areas.

3. The lack of an approved environmentally acceptable management plan for the river and the absence of guidelines to ensure strict adherence to the plan.

It seems to me to be quite unfair that good works supervisors, seemingly not professionally qualified in river engineering, hydraulics, and unversed in fisheries requirements, should be placed in the position of having to take the flak which inevitably comes their way through stuffing up a renowned fishery.

4. It is quite clear to me that the board has little say in, or control of the maintenance work being carried out by its field staff. These would appear to be given free hand to spend their allocations as they wish as long as they keep the owner happy and to hell with the fishery.

Of additional concern is the continual lack of consultation with society staff where fisheries values are under threat - this despite promises made by the board at recent meetings and as required under the Rivers Control Act. (I understand that there is a recent court ruling which specifies consultation as being full discussion and compromise).

Questioned on this, the field supervisor would give no clear reason except that it was not always convenient to consult.

Similar problems exist on the Hamilton Burn, the Oreti and the Mataura and require urgent board attention as to river works policy.

B R McPherson
Otautau

[Asked to comment, the chairman of the Southland Catchment Board, Mr O W Horton, said:]

"Mr McPherson's letter contains a number of points upon which I welcome the opportunity of commenting.

"1. Firstly, work on the rivers of Southland is not carried out by staff without knowledge or authority of the board. Mr McPherson would know as a former local body employee that whereas general approval and policy matters are board responsibility, technical knowledge and methods of work must remain with those trained for it.

"2. I have followed and been kept informed of the comment by the society about the Whitestone but I am puzzled as to why these concerns are now being aired some seven years after the board's management plan for the Whitestone was referred to the society for comment. A wide variety of submissions were received at that time with many supporting and opposing opinions. The board balanced these in the final plan and believes that, although imperfect it addresses the concerns of all parties interested.

"3. The suggestion that the berm areas, now some 1700 acres in extent on the Whitestone, should be enlarged by purchase of some existing agricultural land from the farmers in something that is unlikely to be supported by the landowners. On the contrary, many farmers now see the berm areas as too large especially as their rates are helping control the spread of noxious plants on this Crown-owned land.

"4. The figure of $100,000 per annum is incorrect. The average is much lower than that.

"5. The management plan Mr McPherson requests for the Whitestone exists now and would have been in front of his council while he was a member.

"6. The board policy and the relevant legislation requires the board and staff to "have regard" to fisheries and wildlife interests. That the engineering opinions of the society's staff and that of the board's staff do..."
not always coincide is not surprising. However, I am assured by staff that the required consultation does take place and, in fact, although the staff deal with two societies, most of the problems arise with one. From my knowledge of catchment boards nationally, the Southland Board’s record in including environmental protection and enhancement procedures in its schemes and the historical success of the berm fencing projects in Northern Southland is a creditable one.

Southland Times - Public Opinion
9 February 1989

TROUT RIVERS

Sir, - In reference to Mr McMillan’s reply to my letter published in this column on Friday January 27, there are a few points I wish to take issue over.

Mr McMillan states that “the whole debate on board works on Southland rivers has been led by people with a single purpose use”. This may be correct, and I am assuming that Mr McMillan is referring to anglers. If this statement is so, the I would like to ask why the banner has been taken up only by people with a “single purpose use” in mind?

To me, the answer is obvious, the people with the “single purpose use” in mind are generally more aware and concerned about retaining the natural purity of the water, the natural geographical form of the rivers and the natural levels of rivers. Most of the river users Mr McMillan mentions in his reply have little or no use for the above-mentioned qualities.

For example, the farmers are more concerned with preventing the rivers from eroding their paddocks, and/or using the water of irrigation. Now the latter reason doesn’t necessarily require pure, clear water, and the farmer can be accomplished by careful use of more conservation-minded methods than the gross example witnessed on the Whitestone, for example willow layering, strategically placed rocks and so on.

Mr McMillan mentions the gravel contractors. What care do they have for the water qualities, and natural geographical form of a river? They are merely another form of abstractionist user, after a dollar. What I cannot understand is why gravel must be torn from a river bed when there are vast mountains of gravel to be taken from dry land deposits.

Mr McMillan goes on to mention the jet boaters and canoeists. I am sure that these people have little concern for the purity and quality of the water they are passing over, but by the same token I am positive they have even less interest in boating up or down a carefully dug channel of placid water. There are no thrills or spills available there, one may as well toddle around a lake.

Finally Mr McMillan refers to the industrialists and the local bodies. This is almost laughable. For years these parties have used the waterways as a dumping ground for unwanted chemicals, biological waste, sewage and so on. I have actually worked for an industrial company whose attitude was that every time there was a “flush” in the river, dump the waste, and be damned with Catchment Board limitations.

I feel that Mr McMillan has avoided a direct answer to my original question, by side stepping and introducing non-related issues to provide a camouflage. Nowhere in Mr McMillan’s reply has he outlined any moves to rectify (in any way) the works the Board has carried out on the Whitestone, which appear to have been directly beneficial to only one river user (the farmer) and of no benefit to several river users (fishermen, canoeists, jet boaters, and trampers looking for natural unimproved aesthetic beauty).

Peter J Sayers
Executive Member
N.Z.F.F.A.
Invercargill
Sir, - After 30 years' involvement in management and administration of trout fisheries, I am completely convinced that the key to good trout fishing is good trout habitat.

Here in Southland we have the situation where the Acclimatisation Society is attempting to fulfil its statutory obligations by protecting trout habitat, and the Catchment Board is trying to fulfil its obligations to its ratepayers, which often results in destruction or damage to trout habitat. This is an unfair state of affairs, to say the least.

Mr Owen Horton (ST 4.2.88) says that consultations between Catchment Board and Acclimatisation Society staff regarding river works and their effect on trout fisheries do take place. Unfortunately, this is not always so. In some instances "consultations" have only occurred because acclimatisation society staff have themselves discovered that works are taking place and not because they have been informed beforehand. At this stage little or nothing can be achieved. Catchment Board staff are no more competent to decide what the effects of river works on a fishery will be than Acclimatisation Society staff are to offer engineering opinions, as Mr Horton implies that they do.

Until there is a proper consultation procedure laid down, with input from all interested parties, then I can see little improvement in this situation.

Mr Horton correctly states that the relevant legislation says that the Board shall have "due regard" for fisheries and wildlife. Where this falls down in my opinion is that it does not define what "due regard" means, so that while the Board may receive advice from the society, there is no obligation for it to act on any of it. Until this legislation is amended, there is no guarantee that consultation would be of any use from the angler's view point.

There is no doubt, as other correspondents have pointed out, that the Catchment Board can and has done protection works in such a way that trout habitat has been improved and protected. The Makarewa River at Mr Horton's farm is an excellent example of bank protection by planting and willow layering on the Aparima, Oreti and Mataura provide other good examples.

Why is there not more of this type of work done? Initially it may be more expensive, but by my observation once growth is established it is better able to withstand floods and the "bulldozer technology" used at present. Engineering methods have been applied for for the past 40 years without solving the problem. I think that it is time that the Board considered employing planting of river banks as the major form of protection.

In my opinion, good trout habitat, and thus good trout fishing, is the result of proper soil and water management policy. A river which is good trout habitat is also suitable for other forms of water-based recreation such as swimming, or even just picnicking on the river bank. This is not always the case after the completion of Catchment Board works. While the Board continues to use the present engineering solutions to river control problems, the future as far as all recreational river users are concerned looks bleak.

R Boud
Invercargill
necessity to carry out short-lived diversions.

Why are we now expressing concern after experiencing seven years of the plan in operation? The short answer is "sheer frustration".

The maintenance figure of $100,000 was the figure quoted to us at the December inspection. Admittedly, it could well average less than $100,000, taken over a longer, say 20 year, period.

It goes without saying that technical matters are the responsibility of professional staffing. However, what we are dealing with hers is policy, or rather lack of policy. What we envisage is that non-emergency works likely to damage the fisheries over which we have statutory management responsibility, be adequately documented; with alternatives and estimates, and with an environmental assessment provided by the society technical staff, attached. Only with this information can the Board make intelligent and environmentally acceptable decisions. Minor works would require a less vigorous approach.

We have always given the Board credit for good works beneficial to our fisheries. It is the overzealous and often unnecessary use of the bulldozer with which we take issue.

Mr Horton quotes part of the legislation - "have regard to fisheries and wildlife interests." He must take on board the fact that having regard means proper consultation and that consultation means compromise.

Finally, the statement that he has problems with only one of two societies. Here again he appears to be misinformed. I am advised of a Board letter complaining of adverse comments in the Otago Society's latest annual report. Their difficulties with the Board are similar to ours. To quote: "Boards tolerate destructive river channel .... management practices, without consideration of the adverse impacts on wildlife and fisheries or channel stability."

I stand by my statement that some river works are undertaken without the case specific knowledge of the Board. My authority for this is a comment made at the December inspection, and comments made at a recent informal discussion with several Board members. 

B R McPherson Otautau

Flyfisher - Pub June 1989

LIVELY DEBATE ON "DECLINE" OF SOUTHLAND TROUT FISHERY

An American angler has stirred up a sharp debate on the state of trout fishing in Southland by asserting that it is declining rapidly in some rivers.

He is E. P Anderson of San Francisco, a regular visitor to New Zealand streams who describes himself as an experienced international trout fisherman.

Anderson argued in a long letter to the Southland Times recently that catchment board modifications and the lack of acclimatisation society "teeth" rather than angling pressure had led to the deterioration.

He warned that much of the damage done by willow clearance, erosion, silting and heavy stocking of the land through which the rivers run could not be repaired.

He said: "If the present rate of degradation of rivers continues, my forecast is that the trout fishing in the South Island of New Zealand will be second-rate compared with that in heavily populated countries which have learned that care of environments is cheaper than restoration."

Anderson made these stream-by-stream comments:

Mataura: Fly hatches have greatly diminished, and with them, the trout.

Hamilton Burn: Five years ago there were few cattle on the banks. This season, he saw more cattle than trout in the river.
Oreti: Destruction of pools and heavy silting have reduced the habitat for some of the finest brown trout in the world. Gravel extraction has made the problem worse.

Weydon Burn: A once-fine spawning stream has been nearly destroyed by over grazing and development. The Acton Burn is similarly endangered.

Whitestone: "Considerable damage" to this fine brown and rainbow dry fly river has been done by Catchment Board works.

(The South Acclimatisation Society has also complained about expensive flood protection works on the Whitestone and questioned the economic justification for some modifications of its course).

The General Manager of the Southland Catchment Board, Mr N A McMillan, has responded to the criticisms by pleading the authority acts in accordance with the public wishes of the time.

He said the cry of the 1950s and 60s was development, and Southlanders accepted with both hands the prosperity which followed increases in land drainage, flood protection and primary production.

He added: "Public opinion has now changed and the board is trying to cope with this."

Mr McMillan, an angler himself, said the stability of high country streams had been a concern of the Board for more than 25 years. This had resulted in 340 km of new fencing on both banks of all major rivers and upland streams.

He denied the Board only considered the interests of farmers but said he had spent his whole working life "patching up the country" after sportsmen had liberated deer, rabbits, opossums, goats, hares and wallabies.

Only a super-optimist expected to be able to please everyone when conflicts of interest had to be resolved among jet boaters, fishermen, gravel contractors, the supply of water, the disposal of effluent and protection against flooding.

For the Southland Acclimatisation Society, manager Maurice Rodway said that while many of Anderson's statements were true and echoed comments from other anglers, some could be refuted from the society's own data.

The Mataura is still a very fine brown trout fishery, because it was a large river with a relatively stable bed and in the main, good water quality.

The Society had tried to promote a more conservation-oriented approach to the management of willow trees, but extensive removal of areas like Athol-Garston had led to quite serious loss of good trout and wildlife habitat.

Rodway admitted gravel extraction problems on the Oreti, but said the river still yielded 15 lb to 20 lb trout each year and the average size in the headwaters had not deteriorated since 1937.

In the reaches above Mossburn, there were fish populations of eight to 72 a kilometre, with an average of 25.

Several limit bags of 4-7 lb fish had been recorded this season in the upper Oreti. "We know that anglers can still catch 20 to 30 trout in an
CHAPTER 6 MAN’S INTERACTION WITH NATURE

In terms of land development, berm management and their effects on the Whitestone River

6.1 Scope of Land Development

It is important that the problems associated with the Whitestone River and other ecological and conservational problems are looked at in proportion to the immensity of the overall Land Development scheme of the Te Anau basin.

While the problems that are being discussed are real and very serious the success of the development scheme in terms of returns on the taxpayers investment and ongoing contribution to the Gross National Product should not be overlooked.

To get an idea of the size of the development project I draw your attention to an article by Jack Hockey, and in particular the change in stock numbers over the 12 years from 1953 to 1965.

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FROM TUSSOCK TO PROSPERITY IN 25 YEARS  By Jack Hockey

Transformation of the Te Anau basin in Southland from treeless tussock and scrub to the now prosperous farming area took little more than 25 years.

Land development there started with the acquisition of Lynwood Station in April 1953. This was followed by the addition of part Manapouri Station in March 1957 (Takitimu FS), Mt York Station in September 1959, and Hillside and part Mararoa in April 1960 (Whitestone and Princhester FS). A small proportion of Redcliff Station known as Bullock Hills came in July 1961, added to Takitimu FS, and then Burwood Station in May 1966 (Mavora FS).

Together with other small areas of Crown land, it made an area in excess of 103,000 ha, one of the largest land development projects in New Zealand.

PROBLEMS

The early staff and contractors had to face immense problems in the remoteness of the late 1950s and early 1960s when communication and services were almost non-existent. No power, telephone service only 9 a.m. to 5 p.m. Monday to Friday, a bus service daily during the summer period and
three times a week for the rest of the year, a daily transport service to Lumsden. Medical services were a weekly visit by the doctor from Lumsden or the 80 km trip to Lumsden; no school bus and no secondary school.

Under these conditions it is easy to appreciate the difficulty in getting people to work permanently in the area. Staffing the block was a major problem in those early days.

Except in the favourable areas, early development was disappointing. Pasture establishment was poor with little or no clover, the reversion to nature species was rapid. The thousands of hectares already sown were carrying little better than the original tussock.

TRIAL PLOTS

At this time Mr Nelson Cullen, then principal scientist at Invermay, started a series of trials which covered seed mixtures, sowing time, sowing methods, lime requirements, fertiliser rates, cover inoculation, oversowing etc. Hundreds of trial plots were put down and evaluated over a period of several years.

The major problem was a severe phosphate deficiency and the inability of clovers to nodulate without inoculation. Hence the high mortality of the seedling clovers and resultant poor pasture establishment.

The rates of fertiliser in the trial showed a straight line response up to 2.5 tonnes of superphosphate per hectare. The severity of the phosphate deficiency was then realised.

Thanks to Mr Cullen and his team from Invermay, the major problems were solved and pasture establishment became possible.

At the same time other trials looked at oversowing as a means of developing the unploughable hill country. The original area was adjacent to the Kakapo swamp on the main road and the original cover of fern red tussock and manuka had been burnt off.

This was sown with freshly inoculated clovers and some rye cocksfoot and dogstail, with 500 kg/ha of molybdic super, from the air about the beginning of September. Clover establishment was excellent and by early new year there was a complete cover of red and white clover. However, there did not appear to be any grass because the nitrogen and phosphate levels were so low.

For that reason the first large area on the northern end of the Ramparts was oversown only with clovers in the following spring. However, on the original trial area sown grasses were establishing by the following autumn and had survived until the clover built up the nitrogen levels to promote growth. So all future oversown areas had grass/clover mixtures.

STOCK NUMBERS

At the time development started in 1953, the run properties acquired were carrying about 12,000 sheep and 1,000 head of cattle. Twelve years later the land was carrying 165,000 sheep and over 6,000 cattle.

Settlement began in April 1962 with three sections on Takitimu. By March 1965 the were 12 sections settled, a further four on Takitimu and five on Lynwood.
The feasibility study of the Manapouri hydro-electric power scheme was by then under way and with it a rapid increase in population which required better services. There were no longer any problems with communication, transport, schooling etc so that staffing was no longer restricted. Large scale farming operations could be carried out efficiently.

There were of course more problems cropping up, but the prosperity of the area was now assured.

At the outset of development no one had any idea how it would effect other resources.

Land use capability maps from the early sixties show much of the lower Whitestone Catchment as able to sustain cultivation and cropping with little or no limitation. Ref. Land Use Capability Bulletin 1.

Until the mid sixties resource conservation had held low priority in land development for two main reasons:

1. Money spent on conservation measures increased net development costs and undermined the Lands and Survey Department's aim to establish new Civilian Settlers at a minimum going rate.

2. The full implications of extensive modifications to the environment's most basic resource, land, did not manifest themselves for several years. It was in fact serious flooding and erosion in the Mararoa River catchment in 1964 which finally exposed the need for conservation measures to compliment sustained and intensive land use.

6.2 Berm Boundaries

Inadequacies in early development policies were not so much a function of insufficient administrative foresight but rather of insufficient foreknowledge. Land development operations on the scale of the Te Anau Project were very new and because of inexperience the Department of Lands and Survey was often forced to follow a policy of improvisation, dealing with unforeseen aspects of development as they occurred.

While lack of knowledge can be used as an excuse for some of the earlier mistakes by the department of Lands & Survey, the drawing of the berm boundaries does not fall into this category.

Problems with the river were identified on the early settled properties and this should have provided the Department with the reason for agreeing to a generous Berm area. In reality the Department was very conscious of the national cry for increased agricultural production, and were determined not to "waste" any land. The final berm area was very much a compromise between competing land uses.

As some of the photographs show, parts of the berm area are much too tight.

Regardless of the width of the berm area however there will always be a need for the river to be controlled to some degree if the privately owned farm areas are to be protected.
Photo 3: Examples of berm fencing too close to meander pattern, inevitably putting pressure on stop banks and berm fences.

Photo 4: Examples of berm fencing too close to meander pattern, inevitably putting pressure on stop banks and berm fences.
Photo 5: Example of berm fence outside meander pattern

Photo 6: Example of diversion cut through meander pattern
Photo 7: 1964 photograph showing the amount of flood plain worked by the river before it was modified by the flood protection scheme as shown in 1989 photograph.
Photo 8: 1964 photograph showing the amount of flood plain worked by the river before it was modified by the flood protection scheme as shown in 1989 photograph.
The aerial photographs of a section of the river taken:

1 in 1964, 2 in 1989 show just how much room the river needed before its flood path was restricted by the berm areas. It is an appropriate time to look at why rivers meander rather than flow in a straight line.

6.3 River Meanders

Is there such a thing as a straight river?

- Almost anyone can think of a river that is more or less straight for a certain distance, but it is unlikely that the straight portion is either very straight or very long. In fact it is almost certain that the distance any river is straight does not exceed 10 times its width at that point.

Meanders are not mere accidents of nature but the form in which a river does least work in turning, and hence the most probable form a river can take.

Nature of course provides many opportunities for a river to change direction. Local irregularities in the bounding medium as well as the chance emplacement of boulders, fallen trees, blocks of sod, plugs of clay and other obstacles can and do divert many rivers from a straight course. Although local irregularities are a sufficient reason for a river’s not being straight, however, they are not a necessary reason. Laboratory studies have shown that rivers meander even in "ideal" or highly regular mediums, that the irregularity of the medium has little to do with the formation of meanders is further demonstrated by the fact that meandering streams have been observed in several naturally homogeneous mediums. Two examples are ocean currents (notably the Gulf Stream), and water channels on the surface of a glacier. The meanders in both cases are as regular and as irregular as the meanders in a river. Meanders are invariably formed by the transportation and deposition of the of the material that comprises the medium.

In every case material is eroded from the concave portion of a meander, transported downstream and deposited on the convex portion, or bar of a meander. The material is often deposited on the same side of the stream from which it is eroded.

The reason for meanders in rivers is that it is the best possible way for a river to attain a uniform rate of energy loss, on one hand, and reduce the total energy loss to a minimum on the other.


It is apparent from the paragraph above that the river will always try to form meanders despite and in some cases because of man’s interference, and so threatens the edges of the berm and the farm land beyond.

So while it is likely that there will always be a need for some river control, any "straightening" of the river by man will, over a period of time be reversed by nature.

Refer to aerial photographs (nos. 9 and 10), showing naturally occurring meanders, compared to the present path of the same section of river.
Photo 9: 1964 photograph showing natural meander pattern compared to the present day situation (1989 photograph) where the river has been diverted.
Photo 10: 1964 photograph showing natural meander pattern compared to the present day situation (1989 photograph) where the river has been diverted.
6.4 Protection Planting

Over the years many methods and combinations of methods have been used to contain the river within its berm areas. Many have not been successful and many lessons have been learned.

Prior to 1975 "crack willow" (Salix fragilis) was used for protection planting.

In 1975 the Catchment Board set up a spraying programme to eradicate this species because of its ability to spread rapidly from breakaway branches and the concern about infestation of Lake Manapouri into which the Whitestone water was diverted for hydro power.

Since then through to 1985 the majority of protection planting have been made with 2 main varieties:

1. Goat Willow (Salix caprea)
2. Golden Willow (Salix vitellina)

These slower growing varieties were chosen for their ability to survive the dry climate in Summer when the drying up of the river bed and the lowering of the water table would kill off other species.

For various reasons these 2 species were found not to be successful, and in 1985 protection works were once again resumed using "crack willow" at the request of the ratepayers.

It is important to note that while it is much easier, faster and therefore cheaper to establish "crack willow" it is committing future ratepayers to a considerable ongoing maintenance expenditure to contain these willows to where they are required and prevent them from establishing were they can impede the flooding river.

Protection planting is normally situated in the river bed to prevent undermining of the banks and is usually placed between groynes and in dry runners and abandoned water courses to prevent the river from redeveloping them.

It has been found that the most successful method of establishing willows in the river bed is with the use of heavy poles which are planted to a depth of 2 metres into the ground.

This method requires the use of a "digger" and is very expensive, but because of the results compared to those of other methods, it is considered the most cost efficient. In the last 2 years 11,000 of these poles have been planted and the aim is to have rows of them on the edge of the berm in vulnerable places so that in the future less dozing and diversionary work will be necessary.

6.5 Rock and Groyne Works

In the past there have been vast amounts of money spent on engineering works to help contain the river to the berm area. Rock and groyne works have generally been unsuccessful for a number of reasons, the main ones being the unstable nature of the river bed and the severity of the floods that occur.
Also once a sideways migration was halted, the river dug under the rock and dropped it into the river or the meander moved rapidly down stream leaving the rock high and dry buried in the river bed and of no further use.

Another reason is the supply of rock. Once plentiful, as a by-product of land development, this supply has now been exhausted and the distances that rock would have to be transported make it an extremely expensive option.

The present belief is that planting of willows along the berm boundaries is the best long term protection, and it is a source of concern to ratepayers that, because the ban on "crack willow", 11 years and vast amounts of funding have been lost which could have otherwise been spent on this long term protection work.

The last 5 years have seen a higher than normal incidence of severe floods, and the ensuing damage has accounted for a large proportion of the available funding. As a consequence there has not been the money available to do much long term protection work.

The priority has been to do urgent protection work where the flood has diverted the river to a position where it threatens valuable farm land.

The normal method for this has been to create a diversion channel, and straighten the river away from the farm land.

It is as a result of these works that the present heated and tense situation has occurred and it has tended to polarise the two factions, the Catchment Board on one hand and the Acclimatisation Society on the other.

The Acclimatisation Society have been very concerned over the years at the number of diversion cuts that the Catchment Board has put in the river to divert it away from the edge of the berm and so protect the farmland that the river has been threatening. The Acclimatisation Society maintain that these diversions only tend to straighten the river, increase its rate of flow, decrease the stability of the river and adversely effect the fishery.

By increasing the rate of flow of the river they argue that the problem is only being shifted down the river, and that it will cause a new problem further down stream.

In the opinion of the writer these allegations are perfectly justified. However the options for the Catchment Board are very limited. The Acclimatisation Society has in the past, on a particularly contentious river diversion, suggested that the cost of the diversion far out weighed the value of the farm land that it was trying to protect.

They suggested that the farm land should have been purchased from the farmer concerned, and the river should be allowed to erode back to a point of high ground where it would again meander back towards the centre of the berm.

In the meantime the farmer be allowed to graze a part of the berm with the use of electric fencing to partly compensate for the land he lost.
Theoretically this suggestion is desirable except that the farmer concerned would not consider selling any of his land, and would not take part in the scheme.

This reaction from the farmer is quite understandable when the size of the ballot farms is considered and the quality of a lot of the river flats relative to the majority of the surrounding farm land.

The only alternative is for the Catchment Board to employ the "Public Works Act", and to force the farmer to sell the land.

This is not an acceptable alternative either for the farmers concerned or for the Board who do not wish to use such heavy handed methods which may not have been successful considering the need for Ministerial support.
CHAPTER 7 SUBMISSIONS FROM INTERESTED PARTIES

This chapter is intended to give the parties a chance to outline their own views on the management of the river and submissions are printed as they were received.

7.1 Southland Catchment Board

Southland Catchment Board’s View on Management of River to Balance Southland Acclimatisation Society’s Submission

Board View

When the Board became involved with the river boundaries in the Te Anau district as part of the Lands Department development programme the opportunity was taken to avoid many of the problems encountered on rivers in the older settled areas.

These problems were, insufficient room for rivers to move naturally and unlimited stock access to river and berm vegetation causing extensive modification to it and destruction of the native protection.

It also provided an alternative to the extremely expensive rock protection work needed because of lack of room to allow a river to adopt an alignment satisfactory for successful planting of willows for protection.

Many of the down country erosion control jobs on their own were unjustifiable on economic grounds but failure to attempt to stabilise a reach of river was often followed by a domino effect both upstream and downstream on edge erosion, fencing and farm management.

Very early on the Board refused to carry out the traditional type work on the Whitestone and insisted upon the Department re-locating farm boundaries clear of the river influences.

Part of the philosophy was that the Board was aware that the new young farmers would not have funds to maintain a river frontage and the Board did not wish to be left with them struggling for a living while having a heavy commitment to river control.

By realigning fencing outside the downstream migrating meander pattern it was hoped to have to do minimal erosion control works. Of course at that time no one was sure just what would be the effect of the land development work upstream on river and flood flows.

It was anticipated that this work would result in down country water being allowed to run off before the upstream and heavier rainfall country could be added to on many occasions and hence a minimum increase in peaks but with detrimental effect upon low flows.

There were of course very big floods from the Whitestone from time to time and periodic drying up of sections of the river before land development started but only sketchy records were available.

Naturally there was a compromise to be reached between the Board’s desire for the new boundary fences to be kept well back from the river and the Lands Department desire to produce viable farms. The first area
where the new berm policy was discussed was the most fertile on the Whitestone flats - the Lynwood Block between the Te Anau and Manapouri road bridges. There were several protracted arguments between the Board and its staff and the Department and the new settlers on this.

Fortunately a compromise was reached but not before some one off agreements were made over use of some of the land inside the berm fences for hay cutting, occasional grazing and lucerne cropping.

As time went by the problem of management of "wandering" stock and loss of protection planting and modification of vegetation forced the Board to insist on total stock exclusion. It is well to remember that several of the farmers who had been established on fairly small units naturally viewed losses of 10 - 20 acres from their blocks without any compensating land with hostility.

This resulted in difficulties policing stocking of the berms especially in drought periods.

After the Board had resolved the first problem of acceptance of this new method of river control of the initial 5.5 miles of river the Department agreed to the whole of the river boundaries in the basin being treated by the same method.

Use of a heavy sward of native vegetation and adequate berm land to limit erosion was being demonstrated as an effective alternative to structural works. However, that same berm land was considerably more attractive for farming than the higher stonier land in view of its deeper soils and the ability of the river flats to carry stock through a drought. Most of the district's best hay for winter feed also came from the river flats.

As a result a "yard by yard" debate on the location of the berm fences took place between the parties over tens of miles of river in the basin and in general a compromise was reached that could be lived with. Plans were drawn up and adopted by the Board and the Department and these plans formed the basis for the fencing and stopbanks alignments subsequently established over the following ten years.

The Board throughout the whole of this development period took the view that wherever possible expensive river control should be avoided by giving the river room to adjust, encourage rank growth of vegetation to take the brunt of the force of floods and encourage uses of the berm areas by both the public and farmers which was compatible with the Board's primary aim of preventing loss of soil and damage from flooding.

Initially the problem of crack willow infestation was addressed by attempting to establish smaller less troublesome willow varieties and remove the crack willow. Whereas control of the crack was quickly achieved the alternatives, golden, goat and booth willows and several varieties of poplar did not root well enough or quickly enough to be really effective.

The Board subsequently resolved to revert to use of crack willow after repeated farmer requests in spite of warnings from the Soil Council staff that the crack would combine with the golden willows and produce a seed throwing variety of worrisome potential.
Multiple use of river beds has been the aim of the Board although at times the conflicting requirements of gravel contractors, fishermen, jet boaters and farmers brought the Board into conflict with one or sometimes all of the interested groups.

However, in general the management options selected by the Board for the river have resulted in a compromise which meets most of the requirements of the ratepayers who pay for and are affected by the river, provide opportunities for public use and recreation and preserve a buffer zone between the agricultural run off and the river channel. Long term stability is aimed at by programming live plantings of willows and poplar and although achievement of this will be a long term project it will be matched by the lessening of the mechanical operations in the river bed that have drawn criticism from a section of the public.
Photo 11:

A newly formed channel just downstream of McGregor's Concrete Works, 22 February 1989.

Note lack of vegetation, loose gravelly nature of substrate, low banks. During floods this disturbed gravel easily moves downstream to add to the instability of the whole reach, increasing the need to do even more "works".

Photo 12:

Juvenile brown trout - Native fish (upland bullies and common river galaxias), and stream microinvertebrates disiccated and killed by river diversion completed near Thomas property 16 December 1988. Estimate of typical abundance of these animals multiplied by the area of stream dried out suggests 5000 - 8000 small fish, and about 30 million invertebrates killed by this one diversion.
7.2 Southland Acclimatisation Society

Whitestone River Management and its Trout Fisheries

Background

The Whitestone River is the major tributary to the Mararoa River. It is a relatively small-to-medium sized stream by Southland standards with a mean width of 15 - 28 metres and mean depth of 22 - 51 cm (summer flows) in its middle to lower reaches.

Geologically, the river's valley arises from glacial activity of the most recent glacial period, approximately 10,000 years ago. Glacial activity originally eroded the valley and during the receding phase laid down a relatively flat glacial outwash plain which the river now meanders across and down until it meets the Mararoa. The river now has a meandering nature, and a tendency to move its course significantly during severe floods. Aerial photographs taken prior to the instigation of the heavy control works programme now in place reveal the extent of recent meander movement in the river.

Effect of Control Work

Prior to the heavy control works programme (and in those parts of the river not affected so far by these works) the Whitestone River contained a relatively high number of deep, low velocity pools which provided good habitat for adult brown and rainbow trout.

Evidence for the presence of this river channel form can be obtained by comparing cross sections of the river in "modified" and in "unmodified" reaches. In the modified reach a 1 km section between Kakapo Swamp and Hillside Road the mean width was 23 m (95% Confidence Limits in parenthesis) (18-25) and the mean depth was 29 cm (22-26), but in the "unmodified" reach, near the downstream of J Mills property, the mean width was 19 metres (15-22) and the mean depth was 40 cm (29-51). These measurements indicate the greater average depth in the unmodified reach. In the "unmodified" reach 29% of the transects had a mean depth greater than 50 cm but in the modified reaches no transect means were over 50 cm deep - the deepest being 42 cm. The measurements were made in March 1989.

Further evidence of the tendency for unmodified reaches to be shallow and wide is obtained by measuring bank angle, bank stability, and presence of bank vegetation. These features were measured in each of the two reaches as above. The modified reach had smaller mean bank angles (21 degrees, 95% C.L. 7-35) and the unmodified a mean angle of 40 degrees (21-59). The modified section had 95% of its stream banks soil/substrate eroded and 95% of its stream bank vegetation altered, whereas the unmodified section had 88% of its stream bank soil and vegetation altered. (for a full explanation see Appendix 1).

Although even in its natural state the Whitestone is fairly actively eroding, efforts to "control" it have apparently led to greater instability. Channels in the modified reach tend to have low bank angles, (see attached photo) but unmodified reaches have steeper angles - often one side vertical. This more natural configuration also provides overhanging vegetation and deeper nearshore water - conditions favoured by adult brown trout.
Desirable Objectives for the Whitestone as a Trout Habitat

Appendix 1 contains a summary of conditions that are desirable for good trout habitat. Stream width, depth and its relation is important - deep, narrow streams are better than wide, shallow streams. Deep water - 60-100 cm near the shore is valuable for larger fish and 10 - 30 cm for smaller trout. Stream bank stability, vegetation cover, bank undercut and angle are also useful indications of trout habitat. Where banks are unstable vegetation is absent, there is no undercut and the bank angle is low, trout habitat is poor and few trout, especially larger fish are found.

Channel substrate and its roughness, and its embeddedness in fine material also have an effect. Rough bouldery or cobbled beds that are not embedded in silt or fine material are ideal. Channels which are sinuous are better than straight channels because they provide greater variability and diversity of habitat type.

Good habitat is that which provides a variety of relatively stable instream features that are often in unmodified streams. That part of the Whitestone River bed that has been constructed by the use of a bull dozer tends to be uniform and shallow with an unstable substrate. (See attached photo). These new channels have no vegetation and provide poor adult trout habitat. During hot windy periods these channels expose the river water to sun for more than in a natural diverse river bed configuration so water temperatures increase, reducing the suitability of the habitat further.

The "modified" bulldozer formed channels are highly undesirable from a trout habitat viewpoint. These channels will develop into diverse habitats over time but under the current river control regime there is so much channel realignment occurring development of this desirable configuration is not being permitted.

Management Options

The Whitestone River has an active channel which in recent times migrated about within older terraces. The lateral flatness of the valley, the steep slope of the river, and the generally loose alluvium of its flows through has allowed this pattern. Farm development on the valley floor has gone ahead in the belief that this tendency can be controlled by river works. To date river works have confined the river to boundaries which have not always taken into account historical meander patterns and have been set close to the meander patterns present at the time. The cost of these works has been significant, over recent years being in the vicinity of $100,000 per annum. Most of this money has come from a government subsidy but this will not be available in the future. Another cost has been the loss of thousands of fish every time a river diversion occurs (see photographs).

To illustrate the intrusion of developed land into the meander pattern, measurements of the berm width and the river meander have been made from an aerial photograph of the river just above the Te Anau - Mossburn Road bridge. In the 6 km above the Te Anau Bridge 12 randomly selected transects across the berm reveals a mean of 189 m (S.E. = 13) and the mean wave amplitude of the meander pattern (the perpendicular distance across the river from the outside of one meander to the next) is 219 m, calculated from 17 measurements, S.E. = 29. The berm width is fairly constant (max = 250 m; min = 100 m) but the meander amplitude is more variable as the Standard Error suggests. [Calculations based on 1:25 000]
Photo 13:

Rainbow and brown trout 1 - 2 years old rescued from cut off section as in photo 12.

Photo 14:

One of four adult brown trout rescued from cut off section as in photo 12 and photo 13. Fish ranged in size from 1 kg to 3.2 kg.
On average the berm is slightly narrower than the normal meander pattern. Rivers can be confined if sufficient edge strength can be applied but the ease of achieving this and its cost depends on a number of factors, including the nature of the river. These are matters which can only be determined by thorough investigation.

To the economic cost of control works must be added the loss of fisheries values which cannot be completely quantified in a similar way. A heavily controlled river has fewer fisheries values, its naturalness and intrinsic values are also depleted. Bulldozer works discolor the river making it unfishable during the period of the works which on the Whitestone last summer (1988-89) was quite frequent.

The principle underlying the current works programme mean that given a typical pattern of flooding the amount of time bulldozers are required to make new diversions or prevent damage to older ones or willow plantings will in the short to medium term increase rather than decrease. Furthermore there is no guarantee that the willow planting programme will provide lasting protection given the constricting nature of the stopbanks and berm fences. It is entirely possible that under the present scheme an increasing amount of money will be required each year until ultimately it is realised that no progress is being made. In the mean-time the instream values of the river will be depleted.

**Future Options**

We believe that a management scheme which takes into account the natural processes of the river more adequately, and results in a significant reduction, if not virtual elimination, of dozing in the river needs to be thoroughly examined. Such an investigation should be conducted by an independent agency with experience in the field of river management. The objective of such a study would be to determine if the present control programme will be economically sustainable in the future, and to provide alternatives. An example of the kind of appraisal that is needed is attached to this report. (Wairarapa Gravel Rivers - River Management Study).

**Conclusion**

Current attempts to manage the Whitestone River so that it does not erode adjacent farmland involve the use of heavy control works, primarily relying on river diversions and crack willow plantings to provide edge protection.

The works has significantly degraded the instream values of the river. One of the most important of these is its trout fishery.

The works have been done and are continuing to be done without fully considering the implications of the geological and hydrological forces operating in the river and its valley. Because of this it is likely that the current management strategy will never result in a relatively stable river which no longer regularly threatens adjacent farmland and protect instream values.
A thorough reappraisal of the options in respect of the management of the Whitestone River is required. An independent agency will be required to undertake such a study, which must include all the issues involved.

A thought from another perspective is appropriate in this case.

"The Rivers are our brothers, the quench our thirst.

The rivers carry our canoes and feed our children....

You must remember, and teach your children that the rivers are our brothers, and yours, and you must henceforth give the rivers the kindness you would have any brother".

Chief Seattle 1854

M A Rodway
SOUTHLAND ACCLIMATISATION SOCIETY

July 1989
Southland Acclimatisation Society Submission - APPENDIX

Whitestone River Comparison

Fisheries Habitat

Introduction

Following a summer where at least eight relatively large in-river diversions occurred in the Whitestone River an assessment of the trout habitat was made in two sections of the river. On where diversions had occurred in the past (Hillside Road or lower reach) and one (Talbot Road or upper reach) where the river was in its natural meander pattern.

Methods:

The two sections were from the Hillside Road bridge up stream for 2 km, where diversions have occurred in the past and, at Talbot Road, approximately 13 km farther upstream where, except for one section of river about 1 km long, diversions have not occurred.

This technique used is one described by Platts et al. 1983, and developed in North America. The technique evaluates trout habitat and is based on a number of assumptions. These assumptions have been thoroughly tested and found to be valid in North America. They have not been tested in New Zealand. However, evaluation of trout abundance and stream habitat types in New Zealand by society staff during electrofishing and drift driving and by MAF drift driving teams does not refute these assumptions.

In detail these assumptions are:

1. **Stream width** - streams that are narrow and deep tend to hold more trout than streams that are shallow and side.

2. **Water depth** - provides fish cover, determines stream velocity and is an important element in pool quality and fish environment. In general water depths in a range of 1 - 3 m, depending on other habitat features are ideal. Depths less than 50 cm, especially if no deeper water is adjacent, are less desirable.

3. **Shore water depth** - is critical for fish, especially young of the year. Shore water depth is only greater than zero if the bank angle is 90 degrees or more. Depths of 10 - 30 cm, especially with overhanging cover and low water velocities are used by trout which utilise this habitat.

4. **Streambank soil alteration** - certain land uses especially livestock grazing can start the modification of a stream by causing instability of the bank, leading to changes that will affect fish populations. Streambanks that are severely altered away from natural, or stable vegetated states provide poorer trout habitat than those with unaltered banks.

5. **Streambank vegetative stability** - vegetative stability is a measure of bank stability and erosion. Streams with well vegetated or otherwise stable banks often have good trout populations.

6. **Streambank undercut** - provides cover for fish and often is considered a condition favourable to producing high fish biomass.
7. **Stream channel - bank angle** - angles towards and greater than 90 degrees provide cover. Low angles provide negligible cover.

8. **Channel substrate** - a variety of substrate types - sand/clay to boulders reflects a varied environment and one that is more likely to support a larger fish population. Cobbles and boulders usually indicate good instream conditions for trout, provided other factors which as suitable depth are favourable too.

9. **Substrate embeddedness** - this rates the amount of fine material that covers the dominant substrate and relates to suitability for spawning egg incubation, and invertebrate habitats. As embeddedness increases biotic productivity decreases.

10. **Instream vegetation** - can provide cover for fish. It is also a measure of channel stability. In general the more vegetation the better, although complete coverage is undesirable. This does not include thin films of algae, but does include woody instream vegetation, e.g. drowned trees.

11. **Vegetation grazing** - reduction in herbage by stock grazing or other disturbance e.g. bulldozing, represents a loss of cover, and may lead to stream bank erosion. The greater the loss the poorer the habitat quality.

### Table: TROUT HABITAT VARIABLES
ON TWO REACHES OF THE WHITESTONE RIVER

<table>
<thead>
<tr>
<th></th>
<th>Width (m)</th>
<th>Mean depth (cm)</th>
<th>Shore depth (cm)</th>
<th>Soil alt’n %</th>
<th>Vege %</th>
<th>Under cut (cm)</th>
<th>Bank angle (deg)</th>
<th>Substrate %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upstream</strong> 3/4/89</td>
<td>19</td>
<td>40</td>
<td>3</td>
<td>88</td>
<td>88</td>
<td>Nil</td>
<td>40</td>
<td>C = 65 G = 27</td>
</tr>
<tr>
<td>n = 17 95% C.L.</td>
<td>15-22</td>
<td>29-51</td>
<td>21-59</td>
<td>2</td>
<td>18</td>
<td>B = 4</td>
<td>S = 3</td>
<td>M = 1</td>
</tr>
<tr>
<td><strong>Downstream</strong> 3/4/89</td>
<td>23</td>
<td>29</td>
<td>5</td>
<td>95</td>
<td>95</td>
<td>2</td>
<td>21</td>
<td>G = 48 S = 3</td>
</tr>
<tr>
<td>95% C.L.</td>
<td>18-28</td>
<td>22-36</td>
<td>7-35</td>
<td>9</td>
<td>19</td>
<td>C = 67</td>
<td>B = 13</td>
<td>M = 1</td>
</tr>
<tr>
<td>22/2/89</td>
<td>18</td>
<td>22</td>
<td>0 (not measured)</td>
<td>2</td>
<td>18</td>
<td>G = 19</td>
<td>C = 67</td>
<td>S = 1</td>
</tr>
<tr>
<td>n = 11 95% C.L.</td>
<td>14-23</td>
<td>16-28</td>
<td></td>
<td></td>
<td></td>
<td>Per cent substrate for all transects downstream G = 29 C = 53 S = 2 M = 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* G = gravel, C = cobble, S = sand, M = mud, B = boulder
12. **Vegetation overhang** - provides fish food and cover, and shades the water from sunlight. Does not include undercut bank.

13. **Overall habitat type** - greater diversity usually means greater fisheries production. This a measure of stream bank material and ranges from all fines to all brush though gravel, grass, rubble, boulder, tree roots, trees and sod (soil held together with vegetation).

14. **Channel sinuosity** - is the ratio of channel length between two points on a channel to the straight line distance between two points. Values range between 1 and 4 or more for strongly meandering channels. Meandering channels have greater instream habitat variability and generally are better habitats than straight channels.

**Results:**

The measurements on the Whitestone were limited to widths, depths, shore depths, soil alteration, vegetation stability, undercut bank, bank angle and substrate type to test the technique and because of time constraints. Measurements were taken on two days but 17 transects were taken upstream and 9 transects downstream on the same day under the same flow regime to compare widths and depths. Twenty transects were taken in all but eleven of the transects taken downstream were done during lower flows. Table 1 gives mean values for each parameter.

**Discussion:**

**Depth:**

Mean depth upstream is 11 cm greater than downstream although rather high variability results in an overlap of the 95% confidence limits (15 - 22 up; 18-28 down). However maximum depths in the upstream site were greater, 29% of the means being over 50 cm in depth, whereas the greatest mean depth in the lower section was 42 cm.

In terms of suitable depths for adult trout in the Whitestone, the lower reaches are almost completely unsuitable.

The upper section however does contain water depths suitable for adult trout.

**Soil Alteration and Vegetation:**

Although the stream is berm fenced much of the benefits of this have been lost due to bulldower work in the berm. In the lower section this is particularly noticeable although several transects have relatively stable banks. The lower section had 22% of the transects with soil alteration and vegetation stability less than 75% altered but the upper section had 35% of transects less than 75% altered, suggesting that the stream banks in this area are more stable than those downstream.

Streambank undercut and shore water depth measurements were similar in both areas. There were few areas of undercut bank or deeper water at the shore line.

Bank angles however appeared to be greater upstream than downstream. The mean angle upstream was 40 degrees and the mean angle downstream as 21 degrees. Again confidence limits were wide and overlapping, reflecting the varying nature of stream banks. However, upstream 20% of the bank angles
along transects were 90 degrees or more, and downstream 10% were 90% or more. Since the angles were measured on one side the upper reaches have over half of the stream bank vertical, providing desirable edge habitat in many places. Downstream only 1/5 of the total stream bank provides this same habitat.

Substrate at the upper section has a slightly higher proportion of cobbles which provides better habitat than the smaller gravel although boulders, which are also very useful instream habitat features are more common downstream. These boulders were only found on seven of the twenty transects so were not evenly distributed.

Conclusion:

The pilot study of some trout habitat indicies on two sections of the Whitestone River has attempted to quantify differences, if any, between these sections. Some differences are apparent. Overall the more modified section is shallower, has fewer deep holes or pools, has less stable banks and lower bank angles than the unmodified section. Differences in shore water depth and undercut banks were not measurable. The upper section has a higher proportion of cobbles and the lower reach has an area where boulders are present.

The conclusion therefore is that measureable features that contribute to good trout habitat are more prevalent in the upstream reach than the downstream area. It therefore follows that trout habitat is measurably better in areas which have not been modified by instream works involving dozing.

Further development of the technique including measurement of other habitat features is proposed.

Reference:


Methods for Evaluating Stream.
Whitestone River. Te Anau Bridge to upstream for approximately 5 km. 
From NZ Aerial Mapping 12 March 1979
7.3 Farmers Adjoining the River

This submission has been prepared by the author after speaking to a number of farmers adjoining the river at various points along its length.

Mr Russell Stewart chairman of the Whitestone Ratepayers Association has made available details of the workings and dealings of the Committee.

The most important point to come from the discussions was that of "crack willow".

Farmers considered the removal and eradication of the "crack willow" as wanton destruction.

They contested the decision to eradicate them and have lobbied strongly to have them reinstated as a control species. They resent the time taken to have the decision reversed and feel that it has cost them dearly in rates and time lost in establishing viable protection planting.

I found that the farmers generally supported the works of the Catchment Board and while they expressed a desire to protect the fishery, they were primarily concerned with the protection of their farm land at minimum cost.

Weed spraying was considered to be important by all farmers spoken to.

Listed below are various comments from individual farmers.

1. A complaint that a particular farm was not protected by the original flood protection scheme.

2. One farmer was particularly interested in production tree plantings on suitable areas on the berm with a view to profits funding future protection work. This view was not generally held by farmers.

3. One farmer was keen to see more money spent on aesthetic tree planting on the river bed.

4. One farmer from the upper end of the arable river bed has been against the idea of flood banks opposite his property, but alleges that he was forced into accepting them because they were used on the opposite bank and therefore could have turned the river to flood his property.

He also believes the amount of material the river transports downstream will result in a rise in the river bed level, and will give increasing problems as time goes on. He was emphatic in his belief that river management had started at the wrong end of the catchment, and that all planning and protection work should have started in the head waters instead of trying initially to protect the early developed farms at the lower end of the catchment.
CHAPTER 8  OPTIONS FOR FUTURE OWNERSHIP AND MANAGEMENT OF THE RIVER

The berm area is Crown Land, it has the status of Land reserved from sale under Section 58 of the Land Act 1948.

The Catchment Board and Lands and Survey Department always intended that situation remain, it was the management and control of the berm that was important.

Two methods were discussed:

1. Management vested in the Catchment Board through the Reserves Act.


Lands and Survey preferred the former and offered to process such a vesting.

The Catchment Board wanted management and control under its own Act claiming that method was much more satisfactory.

The National Water and Soil Conservation Authority supported the Catchment Board’s point of view but at this time the Lands and Survey Department began to go through a restructuring process and it became impossible to proceed.

In the mean time the Conservation Act has been passed and as a result the Department of Conservation has become a player, although the Catchment Board has continued to manage the river.

Nothing further has been done by the Board apart from the preparation of the Benn Management Plan, prepared and adopted by the Board after public input.

This plan has addressed the matter of alternative uses for the land within the berms but because the Board has no statutory management powers it has been used as a guide only.

The Board however has endeavoured to keep the river bed free of noxious plants in spite of the responsibility lying with the Crown.

The Crown had no funds for such work and the Board did not wish to see the Whitestone develop into the mess of room and other noxious weeds that the nearby Mararoa River had.

The proposed amendment to the Conservation Act which, if it becomes law in its present form, will present new problems to river managers and adjoining landowners alike.

The amendment proposes that marginal strips of 20 metres wide from the high water line of the River be reserved from sale.

More significantly it proposes that this line should shift as the river shifts and so section 58 boundaries would advance or retreat with erosion and accretion along the river.

It is not appropriate to comment further until the amendment can be seen in its final form.
The important consideration for the future is that the management and control of the river is in the hands of an agency with the expertise to do so.

The Agency must also have access to the necessary funds if it is to achieve the objectives discussed in this report.
CHAPTER 9 RECOMMENDATIONS AND CONCLUSIONS

As soon as land development started and the highway to Te Anau and Milford was recognised as an important communication link, there came a need to control and contain the Whitestone River.

The establishment of a "Berm" area which was reserved from sale, and the subsidised protection work was a national first.

It was over 10 years later that any other Catchment Authority implemented a similar pre-settlement scheme.

There is no reason why this River Scheme can not continue to be a "National Model".

There will always be a need to manage and control the river.

The options and choices for this management and control are many and varied, and lessons have been learned over the years.

The choices made in the future are bound to be compromises and as such are unlikely to please everyone.

Any options are limited by the following restraints.

9.1a Financial Restraints

The amount of money available dictates what programmes are possible and how fast they can be implemented.

This is particularly applicable to the willow pole planting programme.

9.1b Berm Boundary Constraints

That the berm boundaries are in places too narrow is a fact and hugely regrettable.

Generally any river works or plans have to framed within existing berm boundaries.

There may be times when farmers are prepared to trade off small parcels of land in the interests of the long term protection of their land.

Although there has been a recent example of this happening it has been generally established that farmers are not prepared to concede any of their land to the river.

Berm boundaries established in history must remain.

9.2 Management Practices

In the light of present knowledge, gained from the experience of the last 20 years, the policy of berm edge planting with deep planted willow poles should be pursued with all the resources available.
It is important to remember that this option carries with it an ongoing maintenance commitment.

This is a medium to long term solution, and in the short to medium term there will be a need to do some diversionary work, particularly after floods.

While the Acclimatisation Society is not happy with this policy, particularly the diversionary cuts, it admits it has no viable alternatives.

. Diversionary cuts and channel works must be kept to a minimum.

9.3 Independent Study

Southland Acclimatisation Society has advocated the commission of a study by an independent agency experienced in the field of river management.

Critics of this idea argue that all options have already been tried and that the money it will cost could be better spent on planting willow poles.

I believe it is important that the controlling powers are seen to be exploring all the options of river management and fishery protection in particular.

For this reason I believe this study should go ahead provided the two parties can agree on a suitable agency to carry it out and source of funding.

The costs should be shared between the Acclimatisation Society and the Catchment Board.

Given the level of ill feeling over the management of the Whitestone River, I believe this report, even if it does nothing more than agree with present policy, can be justified as an exercise in Public Relations.

9.4 Consultation

In the past there has been huge dissension between the engineers and those that favour a river management program more harmonious with nature generally and the fishery in particular.

To a degree this conflict is healthy but for the system to function satisfactorily it should not be allowed to get out of hand.

In the past there has been a lack of meaningful consultation between the river engineers and the Acclimatisation Society. Decisions have often been taken on site, while a bulldozer was standing by.

While these decisions may well have been the correct ones, and in fact often the only ones, a chance for the Acclimatisation Society, and the ratepayers Liaison committee to give their ideas, may well have averted some of the ill feeling.

It was most encouraging in July 1989 to observe such a meeting taking place on the site of a proposed river diversion. Catchment Board members and staff, Acclimatisation Society staff, and ratepayers liaison committee were all represented.
The outcome was as follows:

The Acclimatisation Society were not happy with the idea of the diversion, but agreed that considering the situation of the river at the time and the amount of farm land threatened, there was no alternative.

The assembling of all those people on an isolated river bed is a clumsy and expensive exercise. I believe however that if, after initial consultation between representatives of the two parties, a compromise can not be reached then more of these meetings need to be scheduled.

9.5 Rating

In the past the funding of the river management has come from Government Grants to the Catchment Board and the Whitestone River Ratepayers.

With the present restructuring of local government and new Resource Management Legislation due out soon it is unclear where funding is to come from in the future.

It is important to view the river as a resource belonging to and for the benefit of all New Zealanders and as such the cost of management must be born in part by all the people.

Those that can be construed as direct users such as adjoining farmers and anglers, must also contribute in a proportion similar to that which has applied in the past.

9.6 Finally

As a result of the foresight of those responsible the berm and the original protection scheme the Whitestone River has been described as a National Model.

Given a will to succeed, adequate funding and cooperation there is no reason why this can not continue, and a stable river and protected fishery can be re established.
CHAPTER 10 RECOMMENDATIONS

10.1 The deep planting of willow poles should continue as fast as funding allows. Threatened areas should be done first.

10.2 Diversionary cuts and other channel works should be kept to a minimum.

10.3 An independent study of the River should be commissioned. It should be undertaken by a person or agency that is agreeable to both the Catchment Board and the Acclimatisation Society. It should be funded by both the above agencies.

10.4 Consultation regarding any future work on the river between all interested parties should be a high priority.

10.5 The cost of managing the river must be shared between the adjacent landowners and the taxpayer.
I would like to thank all people and agencies who have assisted in the preparation of this report, and in particular those listed below.

The Southland Catchment Board for their generous financial contribution to assist with the printing and reproduction of photographs for this report.

The Southland Acclimatisation Society for their generous financial contribution to assist with the printing and reproduction of photographs for this report.

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Mr Russell Stewart chairman of the Whitestone Ratepayers Liaison Committee and all the adjoining landowners to whom I spoke, for their help.

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Ms Gillian Woods for her permission to use material and references from her thesis "Land Development in the Te Anau Basin 1952 - 1983".